

To : People interested in HIPPI-6400-PH copper cable simulations:
 From : Bill McCoy, Raytheon E-Systems
 Date : June 25, 1997

The following is a summary of my Pspice simulation results to date:

1. I have **not** found any equalizer that works from 10 to 40 meters which I think is the absolute minimum range we want for the HIPPI 6400 standard. This dictates an equalizer which is adaptable to the cable length.
2. The jitter on the SGI and all other equalizers is well in excess of the SuMAC budget of 180 ps at 50 meters when running the Widmer pattern.
3. For longer cables, the best results in eye opening, jitter and rise time were achieved using:
 - a) The SuMAC driver (2200 mVp-p 1 Ω source followed by a 200 ps, 55 Ω , delay),
 - b) a minimized 75 Ω trace run (210 ps),
 - c) a 47000 pf DC block (can be located anywhere in run with length balance unnecessary),
 - d) no load resistor,
 - e) 135 ps-55 Ω connector,
 - f) a 12 pf-220 Ω equalizer in the connector,
 - g) Gore 28 gauge cable model,
 - h) 200 ps-55 Ω connector,
 - i) 262.5 ps 75 Ω trace run,
 - j) 200 ps 55 Ω stub terminated in 5.5 pf (all data simulated at this point),
 - k) flyby 350 ps 75 Ω trace run to,
 - l) 75 Ω load.

12pf-220 Ω Equalizer Results

Cable Length	Minimum A-B Eye Opening	Jitter	Max tr, tf	Minimum Diamond Flat Top
(meters)	(mVp-p)	(ps p-p)	(ps p-p)	(ps)
10	<400			
20	670	107	144	1749
40	446	158	361	1481
50	423	278	617	1105

Note: Bold face type indicates out of current limits.

4. Ten meters was simulated with no equalizer.

No Equalizer Results

Cable Length	Minimum A-B Eye Opening	Jitter	Max tr, tf	Minimum Diamond Flat Top
(meters)	(mVp-p)	(ps p-p)	(ps p-p)	(ps)
10	1695	269	141	1590

5. Five meters was in spec using a 39 Ω resistor in place of the 220 in the connector with no peaking capacitor.

39 Ω in Connector Results

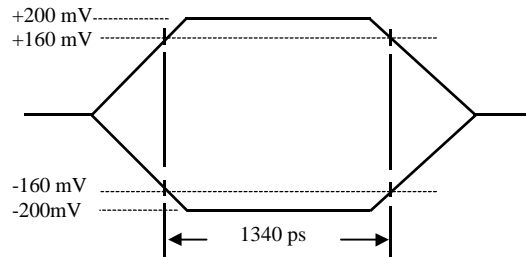
Cable Length	Minimum A-B Eye Opening	Jitter	Max tr, tf	Minimum Diamond Flat Top
(meters)	(mVp-p)	(ps p-p)	(ps p-p)	(ps)
5	1040	144	68	1788
10	2246	214	80	1706

At 2 meters it was out of spec on eye opening due to what appeared to be reflections from the load. The reflections were still there with only the 75 Ω load, so it may be a Pspice problem. PSpice went totally divergent when I tried 1 meter.

There may be better values for the equalizer than the ones I've used. They were primarily driven by trying to get a good eye opening at 50 meters. Almost certainly there are better values for 10 to 40 meters. I recomend putting the equalizer in the connector. This allows the ANSI spec to be finalized with it left to the cable assemblers to make the final value determination.

I suggest we change the spec on the cable to provide minimum eye A-B opening of 400mVp-p and a diamond flat top with definition of the minimum time below -160mV and above +160mV of 1340 ps. This combines the jitter and the rise and fall time spec on the cable and allows a tradeoff between the two parameters.

The following figure illustrates the spec.



1000 ps should be acceptable if fiber is to work at 1 Gbps. That would allow 50 meters with the 12pf-220 Ω equalizer to meet spec.

Herb Van Deusen and Jim Broomall at W.L. Gore are building a cable test card that will test the 12pf-220 Ω and other equalizer configurations. Hopefully these results will be verified.

Regards,
Bill McCoy

I can be reached on E-mail via Craig Davidson at davidson@esy.com
or Robert Clarkson at RobertC@gar.esys.com.